PATENT SPECIFICATION

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COMPLETE SPECIFICATION

DRAWINGS ATTACHED

Nasal Cannula

We, BRUNSWICK CORPORATION, a corporation organised and existing under the laws of the State of Delaware, United States of America, of 69 West Washington Street, Chicago, Illinois, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to nasal cannulae which are utilized to introduce fluids, and particular gases such as oxygen, into one or both nasal passages of a patient.

United States Patent 2,931,358 discloses a nasal cannula which is comprised of a pair of narine tubes and a means for holding the outlet ends of the tubes in a nares-insertable position on a patient. Although the nasal cannula shown and described in that patent represents a substantial step forward in the art, it does have tube outlets which are typical of nasal cannula outlets in practice in the United States today and in practice prior to the invention disclosed in the patent. Whenever nasal cannulae are utilized, there is always present the danger that "nasal burn" will occur in the nasal passages of a patient. "Nasal burn" is caused by evaporation drying of the internal walls of a nasal passage. When a jet of gas such as oxygen is released from the outlet of a narine tube of a nasal cannula, the velocity of the jet, impinging against a portion of an internal nasal passage wall, may cause that portion to be so thoroughly dried that the tissue of the wall appears to have been burned with an accompanying burning sensation being sensed by the patient.

According to the invention there is provided a narine tube having an inlet end for connection to a fluid supply, an outlet end adapted to be positioned in the nasal passage of a patient and to discharge fluid, when said inlet end is operatively connected to said fluid supply, into said nasal passage, and an internally flared section adjacent said outlet end and operative to create turbulence in fluid passing therethrough for discharge from said outlet end by which fluid will discharge from said outlet end at a velocity reduced from that at which it enters said inlet end of the tube.

The invention enables a narine tube to be constructed so that a jet of gas issuing from the tube will have its velocity so reduced that the phenomenon of "nasal burn" is eliminated.

In order that the invention may be well understood there will now be described one embodiment thereof, given by way of example only, reference being had to the accompanying drawing, in which:

Figure 1 is an illustration of a nasal cannula embodying the invention;

Figure 2 is a cross sectional view of a portion of a conventional narine tube adjacent its outlet end; and

Figure 3 is a cross sectional view of a section of a narine tube forming a part of the nasal cannula illustrated in Figure 1.

In order to prevent movement of the proximal end of a flexible plastic narine tube in the cannula from causing a bending or lateral movement of its distal end in the nasal passage of a patient, it has been found desirable to utilize a flexible plastic narine tube having an outer diameter of approximately 0.130 inches in order to remain flexible. This requirement restricts the internal passage of a narine tube to approximately 0.086 inches. Thus when a stream of oxygen is delivered at a customary rate of 4 to 6 litres per minute at atmospheric pressure to a patient, the narrow 0.086 inch stream of fluid is directed against a very small area of the internal wall

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of a nasal passage in a patient. The velocity of such a jet of fluid when the fluid is a gas such as oxygen tends to quickly evaporate any moisture in its direct path in the tissues of the internal wall of a nasal passage, resulting in the aforementioned "nasal burn". In order to keep a narine tube sufficiently flexible, it is undesirable to increase its diameter to reduce the ejection velocity of a fluid from its distal end. The present embodiment of nasal cannula accomplishes a reduction in the ejection velocity of the flow from the distal end of a narine tube without sacrificing the narrow diameter over most of its length or its flexibility, and thereby substantially prevents the occurrence of "nasal burn".

Referring to Figure 1, a nasal cannula is illustrated which has a pair of flexible plastic narine tubes 10 and 11. A plasticized vinyl material is typical of that used in making the narine tubes. These tubes have respective proximal sections 12 and 13 adjacent their respective proximal ends 14 and 15 which are firmly secured in a double channel connector 16 which is illustrated inserted into the distal end of a fluid supply tube 17 which is connected through a regulator (not shown) to an oxygen tank (not shown). Thus the connector 16 provides a means for operatively joining the two tubes 10 and 11 to a single gas or fluid conveying tube.

The narine tubes 10 and 11 pass through and are frictionally held in the respective apertures 18, 19, 20 and 21 of a bridge 22 constructed of flexible plastic tubing. A section of flexible plastic tubing flexibly engages the tubes 10 and 11 to provide a slide 25 which may be manually positioned along most of the extent of the tubes 10 and 11 between the connector 16 and the bridge 22. Therefore, the bridge 22 and the slide 25 provide means for holding the outlet ends of said tubes in a nares-insertable position as is more fully described in U.S. Patent 2,931,358.

As thus far described, the cannula shown in Figure 1 is similar to that illustrated in U.S. Patent 2,931,358. However, referring again to Figure 1, a pair of flared sections 26 and 27 form an integral part of the respective tubes 10 and 11 adjacent respective distal ends 28 and 29. The ends 28 and 29 have a slightly thickened wall to increase resistance to possible collapsing or pinching off of the ends of the tubes.

Figure 2 illustrates the structure of a conventional section 30 adjacent a distal end 31 which is typical of narine tube in use in the United States at the present time.

Figure 3, being an enlarged cross sectional view of the distal end section 26 of the tube 10, shows an internally flared section 40. As illustrated in Figure 2 with a flow of 4 to 6 litres of oxygen per minute, a stream 32 of oxygen ejected from the distal end 31 of the conventional tube 30 is straight and characterized by non-turbulence. The stream 32 ejected from the conventional tube 30 may impinge directly upon the internal wall tissue of a patient and evaporate all the moisture from that tissue so that "nasal burn" results. However, in the flared section 40 the flow of oxygen becomes turbulent and is ejected as a slow churning cloud which, when it impinges upon the internal wall tissue of the nasal passage of a patient, is sufficiently slow that it does not remove all of the moisture by evaporation from the tissues. Although the tube size may be varied, it has been found that an approximate internal diameter of 0.086 inches throughout the length of the tubes 9 and 10 combined with a wall thickness of approximately 0.022 inches provides a very flexible plastic tube. In the flared section 40, the internal diameter is increased from 0.086 inches to an internal outlet end diameter of approximately 0.210 inches. Thus the internal passage cross-sectional area enlarges almost six times in the flared section. The expansion causes a number of small turbulent eddies to form. Thus the flow is greatly reduced in velocity and is turbulent enough to leave the tube 10 in the form of a low velocity cloud mass 41 of greatly reduced velocity. The wall thickness of the end 28 is increased from 0.022 inches to a thickness of approximately 0.026 inches at the outlet end 28. The flared end section 27 is identical to the flared end section 26. Although the approximate dimensions for a preferred embodiment of the invention have been described, those skilled in the art will recognize that these dimensions can be substantially varied without departing from the true scope of the invention as set forth in the appended claims. The internally flared section 40 provides an internal passage whose cross-sectional area enlarges approximately six times in the flared section. When the cloud mass 41 flows against the tissue of the nasal wall of a patient, this velocity is sufficiently reduced that it cannot evaporate all of the moisture from the tissue and "nasal burn" is prevented. Although carrying the same quantity of oxygen as the conventional tube illustrated in Figure 2, the outer diameters of the tube ends 28 and 29 are still only approximately one quarter of an inch. Therefore although the velocity of the flow has been reduced to a level that will not create "nasal burn" the diameter of the tube is still small enough to easily enter the nostrils of a patient. Since the distal end section 27 is identical to the distal end section 26, it will eject a slowed velocity cloud mass similar to 41, thereby preventing "nasal burn" in either nasal passage of a patient when the cannula illustrated in Figure 1 is applied to a patient, as more fully illustrated in U.S.

Patent 2,931,358.

Although a cannula has been illustrated and described, which provides a narine tube for each nostril of a patient, only a single tube may be desired in some applications. Thus, it would not be necessary to join both tubes to a distal end of a gas supply tube such as 17. Further, where only one tube is utilized, the requirement for means of holding the distal end of a tube in a nare-insertable position composed of the bridge 22 and the slide 25 may not be required. All such modifications are intended to be within the scope of the appended claims.

WHAT WE CLAIM IS:—

1. A narine tube having an inlet end for connection to a fluid supply, an outlet end adapted to be positioned in the nasal passage of a patient and to discharge fluid, when said inlet end is operatively connected to said fluid supply, into said nasal passage, and an internally flared section adjacent said outlet end and operative to create turbulence in fluid passing therethrough for discharge from said outlet end by which fluid will discharge from said outlet end at a velocity reduced from that at which it enters said inlet end of the tube.

2. A narine tube according to claim 1, wherein the cross-sectional area of the internal passage of said tube enlarges substantially six times in said flared section.

3. A narine tube according to claim 1 or claim 2, wherein said tube has an internal diameter of substantially 0.086 inches which increases in said flared section to substantially 0.210 inches at said outlet end.

4. A narine tube according to any of the preceding claims, wherein said tube has a wall thickness of substantially 0.022 inches increasing in said flared section to substantially 0.026 inches at said outlet end.

5. A nasal cannula comprising a narine tube according to any of the preceding claims, and means for holding the outlet end of said tube in a nares-insertable position.

6. A nasal cannula comprising a pair of narine tubes according to any of claims 1 to 4, and means for holding the outlet ends of said tubes in a nares-insertable position.

7. A nasal cannula according to claim 6, including means connecting together the inlet ends of said tubes whereby said tubes may be operatively joined to a single gas conveying tube.

8. A narine tube substantially as herein described with reference to Figures 1 and 3 of the accompanying drawing.

9. A nasal cannula substantially as herein described with reference to Figures 1 and 3 of the accompanying drawing.

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1 SHEET *This drawing is a reproduction of the Original on a reduced scale.*